Spectral Signal Indicator Progress Report

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The Spectral Signal Indicator was designed as a receiver acquisition aid for the Pioneer Venus Probe entry in December 1978. A description of the Pioneer Venus SSI operation is given, as well as future implementation plans.

The design of the Spectral Signal Indicator (SSI) was begun in the second quarter of 1977. Its function was to aid in the acquisition of the Pioneer Venus (P-V) probes which were to enter the Venusian atmosphere in December 1978. For the P-V encounter, the SSI system consisted of three racks of equipment linked by an interface panel (located in one of the three racks, see Fig. 1). Since DSS 14 and DSS 43 were to monitor the entry, a SSI system was supplied to each station.

Owing to the mission profile, it was probable that two (and possibly three) probes would enter the Venusian atmosphere simultaneously; therefore, three analyzers at each station were required (two analyzers plus a "hot spare"). Each analyzer consisted of (1) a spectrum analyzer, (2) a spectrum translator, (3) a frequency synthesizer, (4) a spectrum display, (5) an alpha/numeric display, (6) a RF input selector switch, (7) a controller, and (8) an interface panel.

Two elements of the SSI which deserve special mention are the controller and interface panel. The controller was designed to (1) automatically coordinate the controls of the spectrum analyzer, translator, and synthesizer, (2) perform frequency calculations to calculate closed-loop acquisition frequencies, (3) control the remote printer and alpha/numeric display, and (4) perform a self-test of the SSI assembly. The interface panel provided a means whereby the open-loop receiver synthesizer settings and the closed-loop receiver rest VCO settings could be inputted to the controller for use in the acquisition frequency calculations.

A typical P-V operation of the SSI is described in the following example: During the mission precalibration, the operator sets the open-loop receiver synthesizer and the closed-loop receiver rest VCO frequencies into the interface panel. Next, the operator presses the Test switch on the controller, and the controller then performs a self-test of the SSI Assembly. This self-test feature consists of injecting a test signal into the analyzer. The SSI Controller directs the adjustment of all analyzer, synthesizer and translator controls to position the test signal in the middle of the analyzer display. Equipment malfunction and/or incorrect control settings are displayed on the alpha/numeric display.

The open-loop receiver to be monitored is selected on the RF input switch. The operator monitors the spectrum display screen until a signal appears, at which time the cursor is positioned over the signal and the print button is pushed. The controller then computes the S-band probe frequency based on the open-loop receiver synthesizer setting and known configuration. The controller also computes the closed-loop receiver POCA setting. This data is displayed on the alpha/numeric monitor and is also sent to a remote printer located

near the closed-loop receiver operator. The closed-loop receiver operator then sets the computed values into the POCA for quick acquisition.

The P-V configuration was a mission-peculiar design to solve an immediate problem. Now, a more long-range, multimission approach is being pursued. This new design (called Phase II SSI development) is shown in Fig. 2. Phase II implementation is scheduled to be completed in late 1979, at which time the SSI will consist of one rack of equipment (one analyzer), which will be controlled through the Star Switch Controller by the DST. At that time DSS 14, 43 and 63 will each have one operational SSI plus a set of spares.

The Phase II SSI will be configurable for multimission support for Radio Science and RFI applications. All operation of the SSI will be from the DST operator position. A remote display/cursor assembly will allow the DST operator to view the spectral display and control the analyzer cursor position. Signal input, analysis parameters and receiver configuration data will be input to the SSI via the DST. The SSI will supply to the DST operator tuning information for the closed-loop receivers to aid in the acquisition of signals displayed on the display/cursor assembly. The DST operator will have high-level commands at his disposal to scan the analyzer through a range of frequencies, stop when an interesting signal is observed, center the signal in the analysis bandwidth and narrow the analysis bandwidth to get a more detailed picture of the signal.

An interim configuration is being assembled for DSS 14 only, to assist in the Voyager Jupiter Encounter in July of 1979. The SSI will be configured to send spectral data to a remote SSI display located at NOCC via commercial telephone lines.

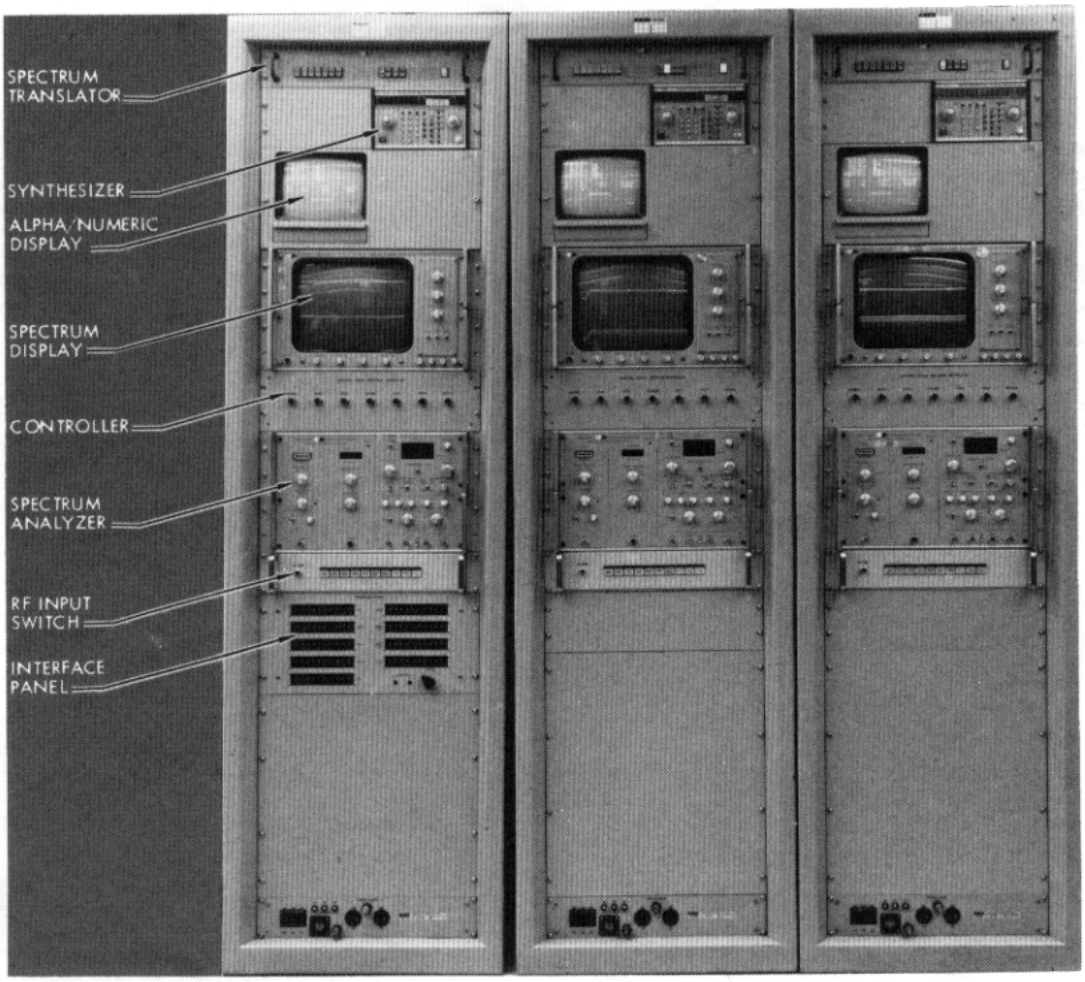

Fig. 1. Spectral Signal Indicator System

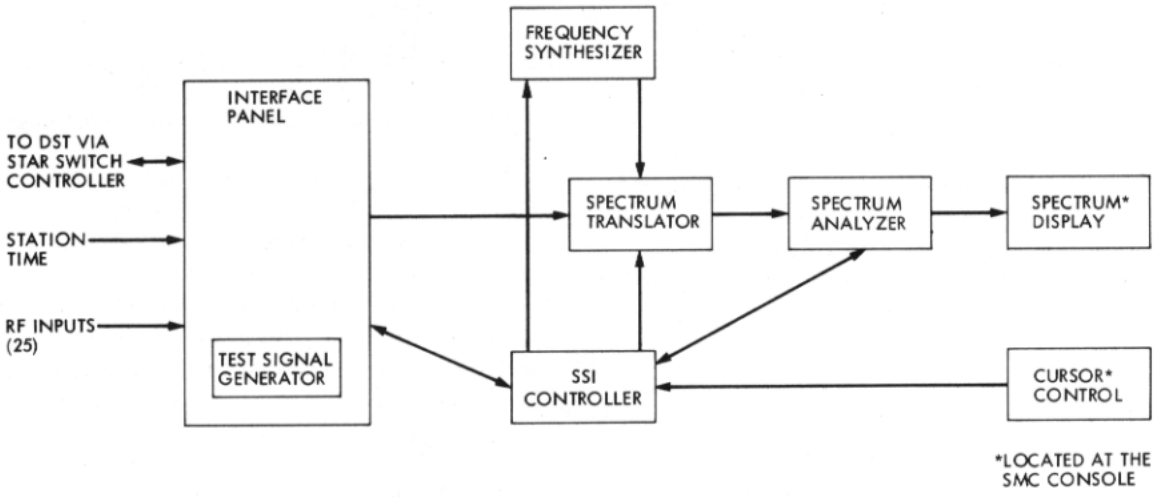

Fig. 2. Phase II SSI assembly